THE PRINCE EDWARD ISLAND ASTHMA STUDY

OCTOBER, 1991

THE
PRINCE EDWARD ISLAND
ASTHMA
MORTALITY AND HOSPITALIZATION
STUDY
1984 - 1988

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OCTOBER, 1991

IN MEMORIAM

This asthma study was carried out largely due to the efforts and energy of Dr. James Fan who was killed as the result of a tragic automobile accident on January 27, 1991.

James was a third year resident in the Community Medicine Program at Dalhousie University. He came to Prince Edward Island during his first rotation in Community Medicine at Dalhousie.

From July through October, 1990, James devoted much of his time to the planning, organization and data collection for this study. His diligence in recording information made it possible to retrieve and analyze the results of his work after his death.

We are indebted to James for the contribution he made to this study. We admire the dedication which he showed to the public service. We appreciate him allowing us to share his friendship and his knowledge.

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SECTION 1

ASTHMA MORTALITY STUDY

1. ABSTRACT

The age standardized mortality rates attributed to asthma from data compiled by Statistics Canada for both sexes and all ages in PEI from 1979 through 1988 were considerably above the Canadian rates over the same time period. To validate asthma as the cause of death, this study involved a review of all 34 asthma deaths reported from PEI to Statistics Canada for the period of 1984 through 1988. Information was obtained from death certificates, hospital in-patient and out-patient/Emergency Room records and autopsy reports. Validation criteria for an asthma death were defined for the study.

Of the 34 asthma deaths reported from PEI over the study period, it was found that only seven (20.6%) were valid. A further five (14.7%) of the deaths were possibly due to asthma. All invalid cases were over 50 years of age, at which age other causes of death appeared to have been confused with asthma. **The results of this validation study suggest that the rate of asthma deaths in PEI has been exaggerated.**

In reviewing the death certificates, inconsistencies were noted as to which of the several listed causes were used as the underlying cause of death. The correct application of coding rules also appeared to contribute to invalid conclusions as to the cause of death.

To determine the actual rate of asthma deaths in PEI would have required the addition of all deaths due to asthma which were designated as being due to other causes (i.e. the "false negatives"). This study did not include a review of such deaths.

There was a high rate of invalid asthma deaths in this study. Therefore, studies of asthma mortality rates and trends should involve validated data, or should focus on cases under 50 years of age when invalidated data appear to be more accurate. It is also recommended that a review of the national reporting system for asthma deaths be undertaken. The process of completing the death certificate and extracting information from it should be reviewed.

2. INTRODUCTION

Asthma mortality rates declined in Canada and the United States from 1965 through 1978, but then increased in these, and several other developed countries, from 1980 to 1987[1-6]. Increases in death rates related to asthma in Canada have been noted particularly in patients under 35 years of age.[9] The asthma mortality rate among those aged 15 - 34 years for 1979-1983 was highest in Prince Edward Island and Alberta.[9] In Prince Edward Island, this rate was based on only one death over the five year period, making interpretation difficult.

Figure 1 shows that the age standardized asthma mortality rates for both sexes and all ages in PEI from 1979 through 1988 exceeded the national rates for all years except 1980. In addition, the mortality rates for PEI were above those of all other individual Canadian provinces from 1983 through 1988. During this time the asthma mortality rates in PEI were higher than those for Canada in both the 35-69 and 70+ age groups (data not shown).

Figure 1. Asthma Mortality Rates, Both Sexes, All Ages, Canada and PEI, 1979-1988

Source: LCDC, Health and Welfare Canada

Asthma mortality rates for PEI are calculated from data extracted from death certificates (Appendix 1). This format of death certificate has been recommended for international use and is utilized by all provinces in Canada as a source for mortality statistics. Rules for designating the underlying cause of death from the death certificate are standard across Canada.[10] Ideally the underlying cause of death should be the last condition listed in Part 1 of the death certificate. However, when more than one condition is listed on the certificate, there are additional rules determining precedence for designation of the underlying cause of death.

Recently, the apparent high death rates due to asthma in PEI have become a concern to health officials as well as members of the public.

Therefore, this study was undertaken, with the following objectives:

1) To validate the diagnosis for all asthma deaths reported in Prince Edward Island between 1984 and 1988.

2) To review any epidemiological information related to these deaths which might point to possible etiological factors warranting further study.

3. METHODS

Statistics Canada provided information which identified the 34 persons who were reported to have died from asthma (ICD-9 code 493 as shown in Appendix 2) in Prince Edward Island between 1984 and 1988. These deaths, as compiled by Statistics Canada, were used to calculate asthma mortality rates for the Province over the study period.

A questionnaire (Appendix 3) was designed to collect all available descriptive data related to the 34 deaths from the following sources:

1) Death certificates from the Vital Statistics Division of the PEI Department of Health and Social Services in Charlottetown.

2) Hospital records (from all seven acute care PEI hospitals) containing information concerning:

   A) previous hospital admissions;

   B) the hospital admission related to the death;

   C) outpatient/Emergency Room visits at the time of death (including reports on those who were dead on arrival);

3) Autopsy reports obtained from PEI hospitals, or for Coroner's cases, from the PEI Attorney General's Department.

The following three criteria were used to assess the causal association between asthma and the death:

1) Validation of a death due to asthma required:

A) Autopsy verification of asthma as manifested by:

i) gross evidence of hyperinflation of the lungs with areas of atelectasis and mucous plugging;

AND

ii) microscopic evidence of:

a) chronic eosinophilic bronchitis characterized by edema and chronic inflammatory cell infiltration of the mucosa, fibrosis of the submucosa with mucous and epithelial plugs in the bronchial lumen;

AND

b) basement membrane thickening and mucous gland hyperplasia and smooth muscle hypertrophy of large airways.

OR

B) A near fatal attack of asthma prior to and associated with the death with no other documented cause of death.

OR

C) Asthma listed as the immediate or antecedent cause of death on the death certificate, with no other documented cause of death, but with medical record information clearly supporting the diagnosis of an asthmatic attack at the time of death.

2) Validation of asthma as the possible cause of death required:

No other clearly documented cause of death available in a person who:

A) was listed as having asthma as the immediate or antecedent cause of death;

OR

B) was a known asthmatic with sufficient documentation on the medical record to implicate asthma as a possible cause of death.

3) Invalidation of asthma as the cause of death required:

A) autopsy or medical record documentation of a death due to a cause other than asthma;

OR

B) insufficient medical record and/or death certificate information to warrant classification as a definite or possible cause of death.

Population figures for the three PEI counties were obtained from 1986 census data published by Statistics Canada[11] and are as follows:

Queen's County	63,460
Prince County	43,680
King's County	19,510
TOTAL	126,650

The death certificate employed by the PEI Division of Vital Statistics is shown in Appendix 1. The cause(s) of death is(are) recorded in Part I as immediate (Ia) on line one, antecedent (Ib and Ic) on lines two and three respectively, and other significant conditions on lines four and five in Part II (referred to in this report according to the number of the line on which the cause is located).

MEDICAL CERTIFICATE OF DEATH

		Approx. interval between onset & death
24. DATE OF DEATH: Month *(by name)*, day, year		
25. CAUSE OF DEATH	I	
Part I Immediate cause of death	(a)	.....
	due to, or as a consequence of	
Antecedent causes, if any, giving rise to the immediate cause (a) above, stating the *underlying cause last*	(b)	.....
	due to, or as a consequence of	
	(c)	.....
Part II	II	
Other significant conditions contributing to death but not causally related to the immediate cause (a) above	.....	.....
	.....	.....

4. RESULTS

4.1 All 34 Study Cases

Hospital records were available for 32 (94.1%) of the 34 cases. Records of at least one previous hospital admission were located for 31 (91.2%) of cases and hospital records related to the death were found for 19 (55.9%).

No deaths occurred among persons under 20 years of age, six (17.7%) among those between 20 and 60 years and 28 (82.3%) among persons over 60 years of age.

Fourteen (41.2%) of the cases were female and 20 (58.8%) were male. Eight deaths occurred among residents of King's County, 13 among Prince County residents and 13 among those residing in Queen's County.

Nineteen (55.9%) of the deaths occurred in hospital and 15 (44.1%) occurred at home or in a nursing home.

The distribution of cases by month of death is shown in Figure 2 and reveals a peak in the deaths in February when there were six.

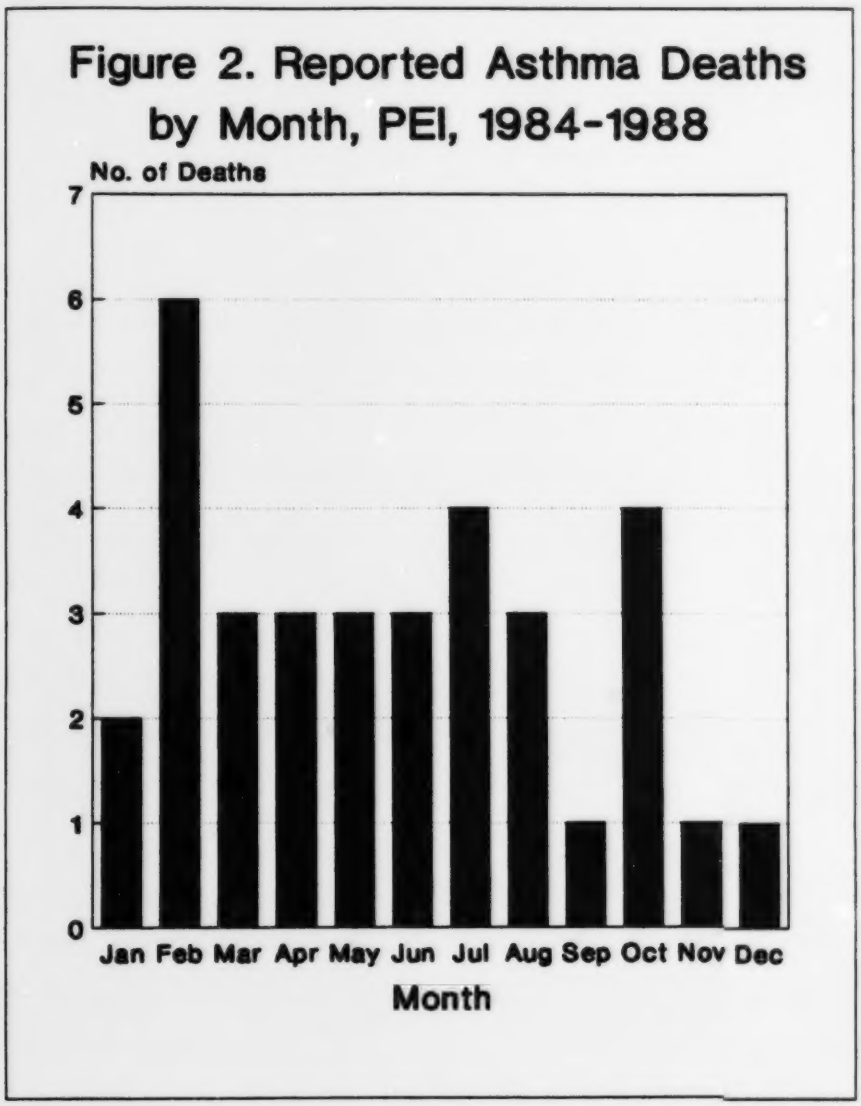
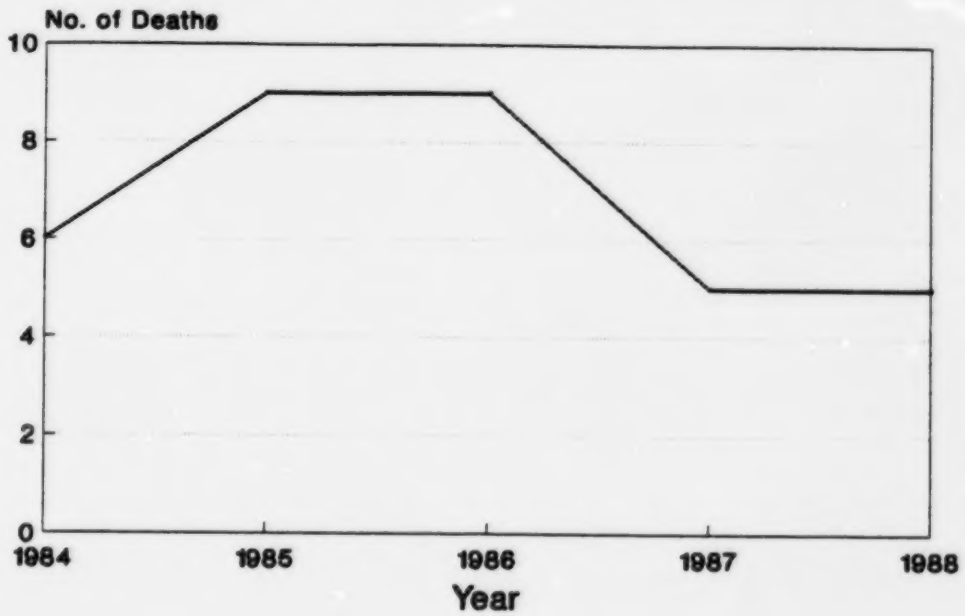


Figure 3 shows the distribution of asthma deaths by year, with the most being in 1985 and 1986 when there were nine.

Autopsies were performed on eight (23.5%) of the deaths.

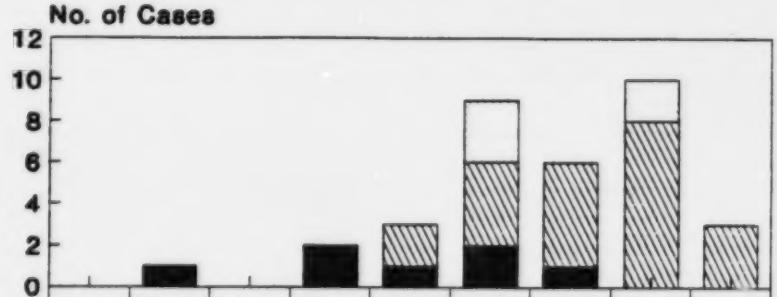
Figure 3. Reported Asthma Deaths by Year of Occurrence, PEI, 1984-1988



4.2 Valid Asthma Deaths

Of the 34 deaths attributed to asthma, the diagnosis could be validated in only seven (20.6%). Figure 4 presents the age distribution of valid, possible and invalid cases. No deaths occurred among those under 20 years of age, all three of the deaths attributed to asthma in the 20 to 50 year age group were valid, but only four (12.9%) of the 31 deaths among those over 50 years were validated.

Figure 4. Age Distribution of Valid, Invalid and Possible Asthma Deaths, PEI, 1984-1988



Age(Years)	00-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Possible Cases	0	0	0	0	0	3	0	2	0
Invalid Cases	0	0	0	0	2	4	5	8	3
Valid Cases	0	1	0	2	1	2	1	0	0

Valid Cases (7/34=20.6%) Invalid Cases (22/34=64.7%) Possible Cases (5/34=14.7%)

Four of the validated cases were female and three were male. Five of the seven died in hospital. Death-related medical records were available for five of the cases. One died in 1985, four in 1986 and two in 1987. One (14.3%) was from King's County, six (85.7%) were from Queen's County and none were from Prince County.

An autopsy was performed on five of the validated cases with the pathology report supporting the diagnosis of asthma.

Of the seven validated cases, asthma was listed on the death certificate on the first line of the causes of death on two, on the second line on four and on the third line on one (there were no blank lines preceding the cause listed last).

Information was available on five of the validated cases concerning the antiasthmatic medications which were being taken previous to death. Three were receiving B_2 agonist drugs, two were taking xanthines and two were on corticosteroids (one was on a combination of a B2 agonist and a xanthine medication).

One case was noted to be allergic to penicillin but no allergies were identified in the charts of the other six cases (relevant information was available on five of the cases).

4.3 Possible Asthma Deaths

An additional five (14.8%) of the total 34 cases were classified as being possible asthma deaths. Two of these were female and three were male. Three were from King's County, one was from Prince County and one was from Queen's County. Two died in hospital. None had an autopsy performed. All were between 60 and 89 years of age, as shown in Figure 4.

Four had a history of asthma, and four had documentation of at least one severe asthmatic attack in the past.

4.4 Deaths Not Due to Asthma

Of the 34 deaths, there were 22 (64.7%) for which there was insufficient information to classify the cause of death as being due to asthma. Of these 22, eight (36.4%) were female and 14 (63.6%) male. Four(18.2%) were from King's County, 12 (54.6%) from Prince County and six (27.3%) from Queen's County.

Figure 4 includes the age distribution of invalid cases. None was under 50 years of age, six (27.3%) were between 50 and 70 years of age, and 16 (72.7%) were over 70 years of age. Autopsies were performed on three (13.6%) of the invalid cases. Twelve (54.6%) of the 22 cases died in hospital.

Asthma appeared on the first line of the death certificate for two (9.1%) of the invalid cases, on the second line for 11 (50%), on the third line for seven (31.8%), and on the fourth line for two (18.2%).

For 18 (81.8%) of the 22 cases, a disease or condition other than asthma (myocardial infarction, chronic obstructive pulmonary disease, pneumonia, pulmonary embolism, etc.) appeared on the death certificate before asthma. After review of available medical records on all of these cases, it appeared that the condition listed before asthma was a more likely cause of death than was the asthma.

5. DISCUSSION

Only 20.6% of the reported asthma deaths which occurred in PEI from 1984 through 1988 could be validated as being due to asthma. If the asthma mortality rates for PEI are adjusted to reflect the percentage which were validated, the mortality rates for asthma would be lower than the national rates in four of the five years between 1984 and 1988 (if possible cases are included the rates would be lower in three of the five years). However, validation of national rates is necessary before comparisons can be made.

In this study, it was found that asthma as a cause of death was much more likely to be valid in cases under 50 years of age. This finding has also been reported in a study by Sears, Rea and deBoer.[12] Studies of asthma based on mortality data which are invalidated may therefore be more accurate if the data are limited to deaths among those under 50 years of age. We found that the records of patients over 50 years of age typically documented other co-morbid conditions, particularly chronic obstructive lung disease and cardiovascular diseases. The presence of such diseases appears to have created ambiguity, either when the death certificate was filled out, or when information was extracted and coded from it.

In examining the death certificates of invalid asthma cases, it appeared that in most instances when the physician entered the diagnosis "asthma" on the certificate, it was not intended that it be designated as the underlying cause of death. The physician appeared to be simply recognizing asthma as a condition which had, at some time, been diagnosed in the patient. In many cases the physician had also indicated on the death certificate that the patient had another serious condition which conceivably was responsible for the patient's death.

The death certificate used in PEI is standard for all of Canada. It includes five lines for diseases and conditions which are designated as "immediate cause", "antecedent cause", and " other significant conditions". In reviewing the completed death certificates, it appeared that there were frequent inconsistencies in the way in which the actual cause of death was designated by the physician certifying the death. These inconsistencies were observed in validated, possible and invalidated cases alike.

International rules apply in coding the causes of death for all diseases when the information is taken from a death certificate.[10] The standard practice is to designate the condition which appears last in Part 1 of the death certificate as the underlying cause of death. However, some conditions take precedence over others regardless of the order in which they are listed on the death certificate (i.e. asthma takes precedence over chronic obstructive lung disease). Two factors appear to have contributed to the high rate of invalid conclusions noted in this study. One is physician misunderstanding regarding how the death certificate is to be completed. Second is the misclassification of the causes of death resulting from the correct use of international coding rules.

There are several limitations to this study. The total number of cases and the denominator population is small. The autopsy rate was low and some hospital records lacked specific details related to the death. Relatives of cases who might have been able to provide relevant information were not interviewed. Because most of the deaths occurred among patients over 50 years of age, co-existing medical conditions (particularly chronic obstructive lung disease) were present and likely resulted in some diagnostic ambiguity due to the overlapping of symptoms in many of these conditions. In addition, no attempt was made to determine how many valid asthma deaths were attributed to other causes over the study period.

The small numbers of validated cases in this study make it impossible to evaluate environmental or other factors which might be contributing to the death of asthmatic patients in the Province. In addition, there was a limited amount of documentation on the charts of some patients making it difficult to evaluate some of the variables of interest. However, no particular triggering factor was mentioned frequently enough among those who died of asthma to implicate possible causes.

The question of whether asthma is more prevalent in PEI than in other provinces is not addressed in this study; a population survey is required to obtain such information.

Further asthma mortality validation studies are recommended. A similar study in other provinces would make comparison data available and determine if mortality rates due to asthma in Canada are high in comparison with other countries. A validation study of "asthma" deaths over different time periods might help to assess trends in mortality rates.

The findings in this study suggest that the coding rules for designation of asthma as an underlying cause of death should be reviewed. Such a review might also include the rules for other diagnoses as well. In addition, there is an apparent need for a more valid system of compiling the causes of death on a death certificate. Thought should be given as to whether this can be achieved through physician education or revision of the death certificate itself.

SECTION 2
ASTHMA HOSPITALIZATION STUDY

1. ABSTRACT

Statistics produced by Health and Welfare Canada from data compiled by Statistics Canada revealed that rates of discharge/separation for asthma in PEI between 1979 through 1987 were approximately three times higher than the average rates for all of Canada (Figure 5).

For this study we reviewed the hospital records of a 10% random sample of the 4230 patients discharged from PEI hospitals with a diagnosis of asthma between 1984 and 1988. The diagnosis of asthma was found to be valid in 69% of cases.

The major reason for an asthma "case" being considered invalid was the absence in the patient's hospital records of a history of asthma or previous signs/symptoms of asthma.

The diagnosis of asthma was valid for approximately 88% of patients aged 10 to 39 years of age. Among those younger than 10 or older than 39, the rates of validity of the discharge diagnoses were much lower.

A peak in the number of hospitalizations was noted in the fall and a lower peak in the spring.

The percentage of valid discharge diagnoses was higher in those hospitals which used the HMRI system (Hospital Medical Records Institute) of reporting the discharge diagnosis.

The average duration of hospitalization for asthma was 5.35 days.

The most commonly identified triggering factor for an asthmatic patient who was admitted to hospital was an upper respiratory tract infection. The commonest allergies noted were to penicillin, dust and feathers. These allergens however, were rarely responsible for the asthmatic attack which resulted in the patient's admission to hospital.

The findings of this study should be interpreted in light of the following factors which might have biased some of the study observations:

1) The availability of hospital beds may have varied among the participating hospitals over the study period.

2) The case definition for asthma and rates of detection may have varied among physicians.

3) Physician practices may have differed with regard to the criteria for admission of an asthmatic patient.

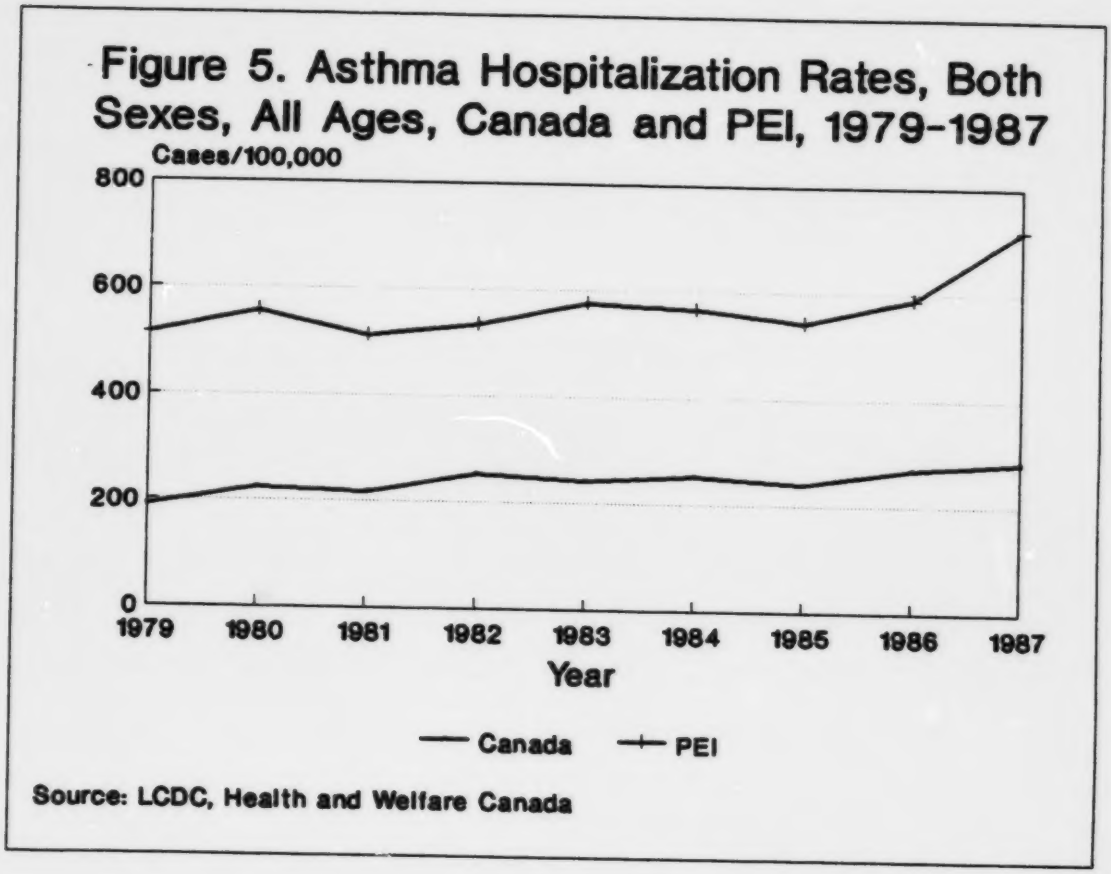
4) Confusion may have arisen when an asthmatic had other concurrent illnesses, one of which may have been listed as the discharge diagnosis rather than asthma.

5) Coding inconsistencies or practices may have resulted in misclassification of the discharge diagnosis.

In addition, this study involved only those asthmatic patients discharged from hospitals and may not reflect a true picture of all asthmatics in the Province. A study designed to examine the validity of asthma hospitalization data across Canada, as well as a survey designed to assess the prevalence and severity of asthma among Canadians in all provinces, is strongly encouraged.

2. INTRODUCTION

In recent years, there have been reports of an increase in morbidity due to asthma which began in the 1970s in Canada and several other Western counties.[1,6,13-16] Figure 5 shows the asthma hospitalization rates, based on hospital discharge/separation data, for both sexes of all ages in Canada and PEI from 1979 through 1987. The rates in PEI were significantly higher than those in Canada. Only one other province experienced a rate above 400/100,000 during that period and that for the year 1984.



These relatively high rates of hospitalization for asthma in PEI are consistent with the high rates of mortality due to asthma in the Province (Figure 1, Page 8 - Mortality Study).

To further investigate the apparent excess in asthma hospitalizations we designed a study with the following objectives:

1) To validate the diagnosis of all asthma separation/discharges in Prince Edward Island between 1984 and 1988.

2) To review the medical records of all patients discharged with a valid diagnosis of asthma in order to identify any possible etiological factors.

3. METHODS

A list was obtained from the seven PEI acute care hospitals of all 4230 patients discharged with a diagnosis of asthma between 1984 and 1988 and reported to Statistics Canada. The study sample consisted of a 10% sample of 423 charts selected at random from all admissions during this time period. Admissions, rather than patients, were sampled because individuals might contribute more than one admission to those eligible for selection over the study period.

The residence of patients was classified as rural or urban in accordance with census data published by Statistics Canada.[18,19]

Rates of hospitalization were standardized by the direct method, using the 1971 population of PEI as the referent. Standardized morbidity (hospitalization) ratios (SMR) for valid asthma cases by county and rural versus urban residence were assessed using the Poisson Ratio Test.

The criteria for designating a discharge as being due to asthma differed among PEI hospitals. In five of the seven hospitals (accounting for 181 or 26% of the acute care beds in the Province) the discharge diagnosis was based upon the physician having designated asthma as the first condition in the chart under the heading, "Primary Discharge Diagnosis". In these hospitals the Medical Records Department staff did not change this diagnosis.

In the other two hospitals (providing 513 or 74% of the acute care beds in the Province) the Medical Records staff used the Hospital Medical Records Institute (HMRI) system. Under this system the patient's chart is reviewed after discharge and the discharge diagnosis is designated as that condition which is responsible for the longest period of the patient's stay in hospital, regardless of what the physician has recorded as the "Primary Discharge Diagnosis".[17]

Differences in rates based data obtained from HMRI versus non-HMRI systems were assessed using the chi-squared test for comparing proportions.

The charts were reviewed by one of two physicians who conducted the study and data were extracted using a questionnaire designed for the study (Appendix 4 - Asthma Hospitalization Questionnaire)

Criteria for the validation of a discharge diagnosis of asthma (ICD-9 code 173) were as follows:

1) The principle presenting complaint and reason for the admission must be asthma-specific;

AND

2) The patient must be found to meet at least one of the criteria in each of the following three categories:

A) History of Asthma

i) asthma diagnosed previously;
ii) previously hospitalized with asthma;
iii) documentation of previous airflow obstruction;
iv) documentation of previous bronchial hyperresponsiveness.

B) **Presence of symptoms while in hospital**

i) shortness of breath;
ii) wheezing;
iii) cough.

C) **During hospitalization**

i) documentation of clinical airflow obstruction;
ii) improved after specific and active treatment for asthma.

OR

3) If the patient has documentation of a methacholine test indicative of asthma, or if a pulmonary function test shows evidence of reversible airway obstruction, the patient is considered to be asthmatic regardless of what criteria are met in Section 2.

On the other hand, if a methacholine test or pulmonary function test indicates that the patient does not have asthma, it is considered that the case is not asthmatic regardless of what criteria are met in Section 2.

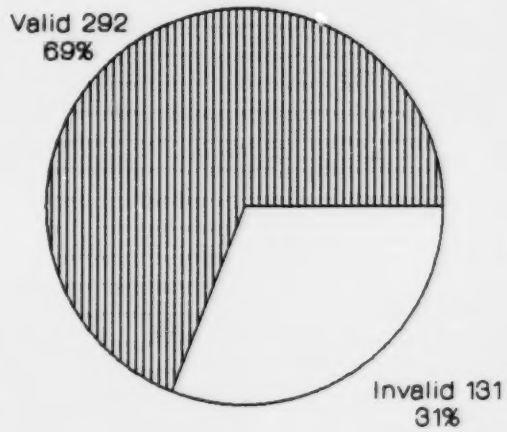
The two physicians then reviewed the completed questionnaires and classified all the discharge diagnoses as valid or invalid according to the pre-defined criteria.

4. RESULTS

4.1 Valid Cases

Figure 6 shows that 292 (69.0%) of the 423 cases reviewed were found to be valid and 131 (31.0%) were invalid.

Figure 6. Validity of Asthma Diagnoses among Patients Discharged from PEI Hospitals, 1984-1988



4.2 Criteria not Satisfied by Invalid Cases

Table 1 shows the number of invalid cases for which specific validity criteria were not satisfied. A total of 105 (80.2%) of the invalid cases did not have a history of asthma and 51 (38.9%) were admitted to hospital for a reason other than asthma. In addition, there was no documentation of clinical airflow obstruction or improvement after administration of specific antiasthmatic therapy in 32 (24.4%) of cases. Nineteen (14.5%) did not exhibit symptoms of asthma on admission or while in hospital. Only four (3.1%) had a methacholine test or pulmonary function test which indicated that the patient was not asthmatic.

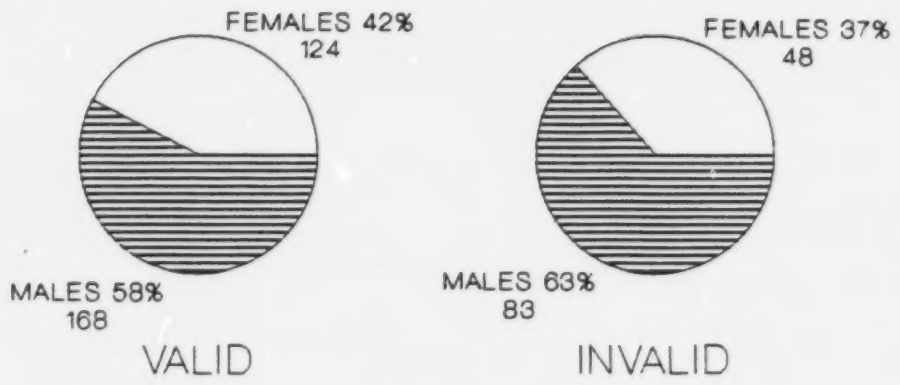
Table 1. Validity Criteria not Satisfied among 131 Invalid Asthma Patients Discharged from PEI Hospitals, 1984-1988

CRITERIA	NO. OF CASES (%)*
History of Asthma	105(80.2)
Admission for Asthma	51(38.9)
Airflow Obstruction or Therapeutic Response	32(24.4)
Asthmatic Symptoms on Admission	19(14.5)
Negative Methacholine or Pulmonary Function Test	4(3.1)

* Multiple Criteria not Satisfied by Some Cases

4.3 Sex Ratio

Figure 7. Distribution of Valid and Invalid Asthma Cases Discharged from PEI Hospitals by Sex, 1984-1988



Among the valid cases there were 124 (42.5%) females and 168 (57.7%) males for a male:female ratio of 1.35:1.00. Among the invalid cases 48 (36.6%) were female and 83 (63.4%) were male, as shown in Figure 7. Table 2 reveals that the rate of hospital discharge/separations for asthma in PEI over the study period of 1984 - 1988 was 194.5/100,000 for females and 267.1/100,000 for males.

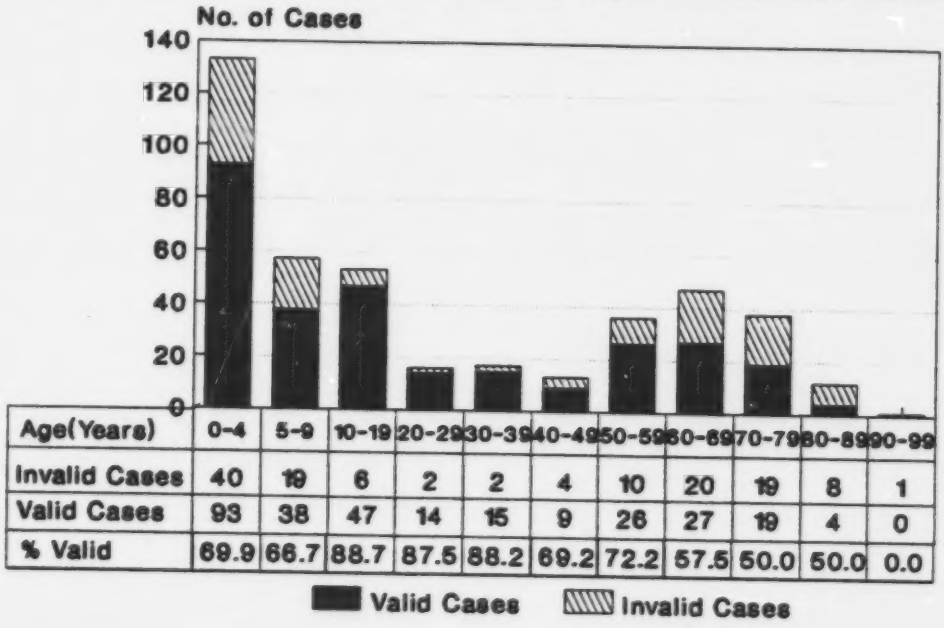
Table 2. Rates of Valid Asthma Cases Discharged from PEI Hospitals by Sex, 1984-1988

SEX	RATE/100,000
Males	267.1
Females	194.5

4.4 Age

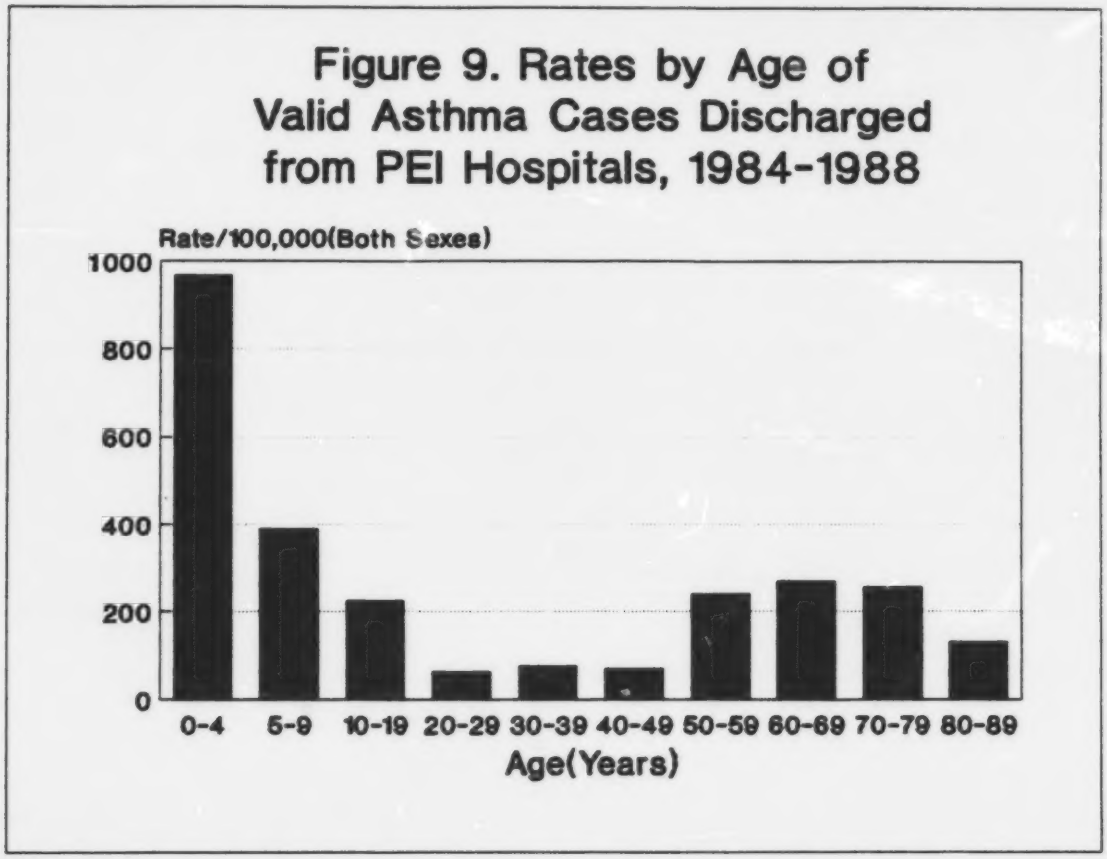
Figure 8 shows the distribution of valid and invalid cases by age group. The lowest percentage of valid cases was among patients aged 0 - 9 and over 40 years, while the highest percentage of validity was observed among the 10 to 39 year olds.

Figure 8. Distribution of Valid and Invalid Asthma Cases Discharged from PEI Hospitals by Age Group, 1984-1988



Age(Years)	0-4	5-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Invalid Cases	40	19	6	2	2	4	10	20	19	8	1
Valid Cases	93	38	47	14	15	9	26	27	19	4	0
% Valid	69.9	66.7	88.7	87.5	88.2	69.2	72.2	57.5	50.0	50.0	0.0

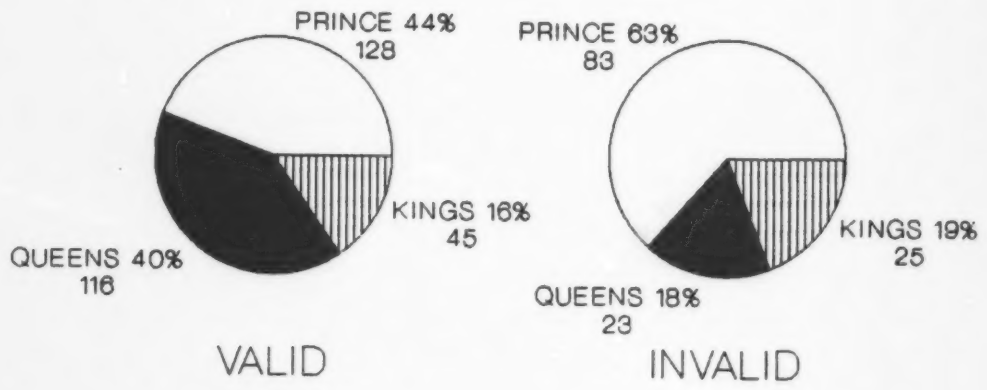
The rates by age group of valid asthma hospital discharge/separations for both sexes combined are shown in Figure 9. The rates were highest among children aged 0 to 4 years, lowest in the 20 to 49 year olds, and intermediate among those 5 to 19 and adults 50 and over.



4.5 County

Figure 10 shows the distribution of valid cases according to the county of their home address. There were 128 (44.0%) from Prince County, 116 (40.0%) from Queen's County, and 45 (16.0%) from King's County. Three were from out of Province.

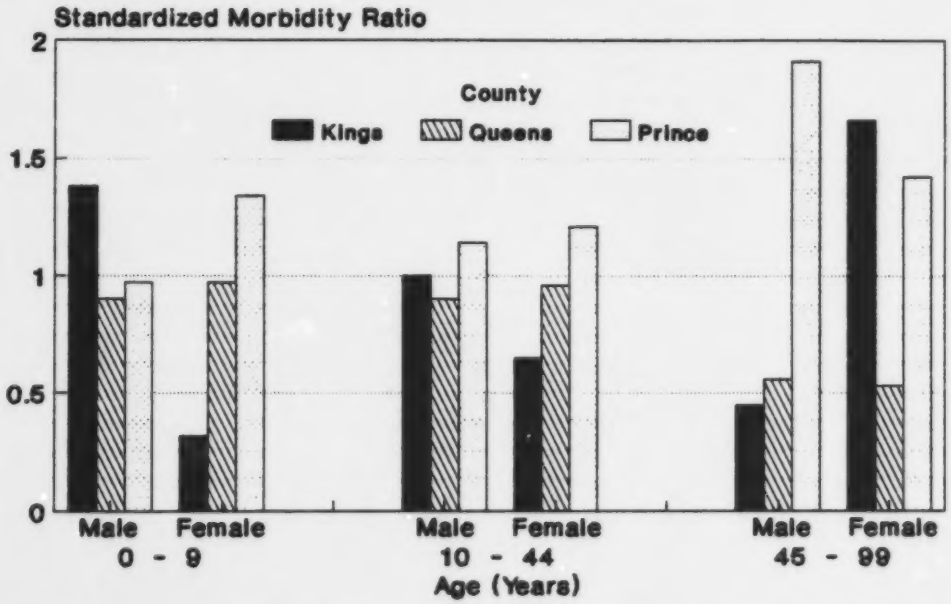
Figure 10. Distribution by County of Valid and Invalid Asthma Cases, PEI, 1984-1988



Of the invalid cases there were 83 (63.0%) from Prince County, 23(18.0%) from Queen's County and 25(19.0%) from King's county. The rate of validity among cases resident in Queens County was 83%, in King's County 64%, and in Prince County, 61%.

Figure 11 shows the age- and sex-adjusted morbidity (hospitalization) ratios (SMR) for valid asthma cases by county of residence. The SMR was significantly low (p-value <0.05) for males and females aged 45-99 in Queen's County and significantly high (p-value <0.01) for males aged 45-99 in Prince County. There was no significant difference in the SMR of valid asthma cases based on county of residence in any of the other age and sex groups.

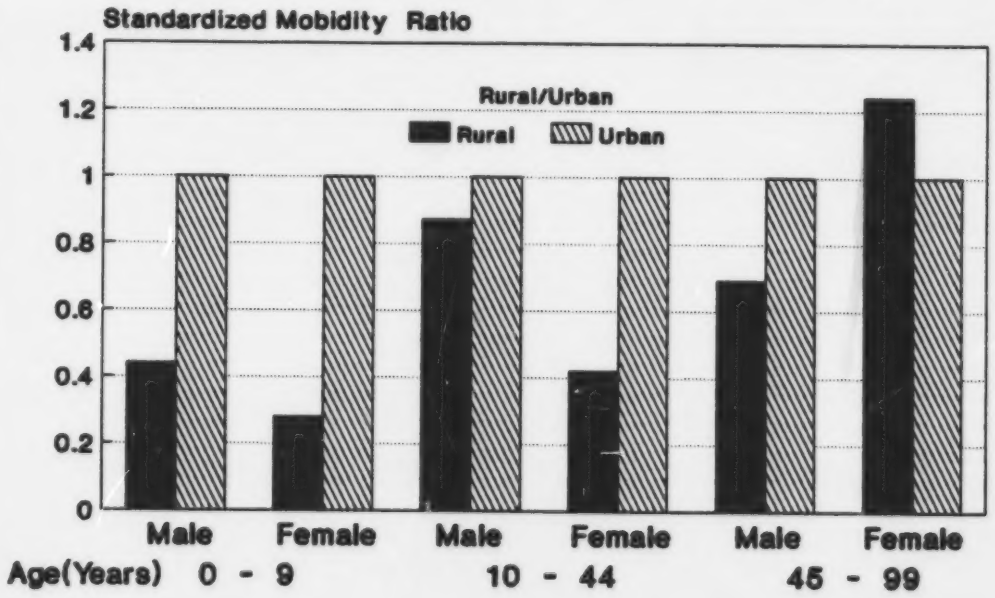
Figure 11. Age and Sex Standardized Asthma Morbidity Ratios by County, PEI, 1984-1988



4.6 Rural Urban

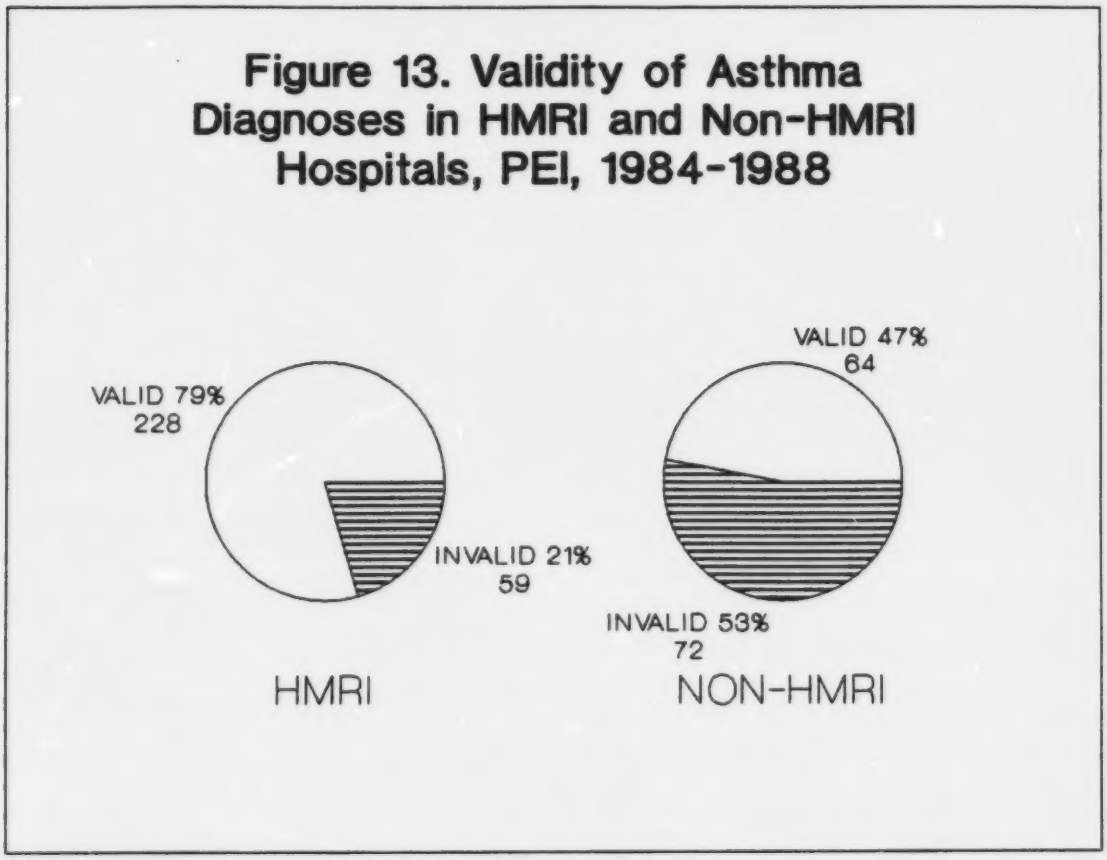
The age-standardized asthma morbidity (hospitalization) ratios by rural/urban residence is shown in Figure 12. For both males and females (of all ages) the morbidity ratio was significantly lower among rural than urban residents (p-value <0.01). By age group the SMR was significantly lower for rural residents of both sexes aged 0 to 9 and for females 10 to 44 years of age (p-value <0.01). There was no significant difference in the SMR for rural as compared with urban residents in any of the other age or sex groups.

Figure 12. Age Standardized Asthma Morbidity Ratio by Rural/ Urban Residence,PEI, 1984-1988



4.7 HMRI Hospital/Non-HMRI Hospital

Figure 13 shows that the percentage of valid cases discharged from the two PEI hospitals using the HMRI system of reporting was 228 (79.4%), while in the five hospitals not using the HMRI system, 64(47.1%) of 136 cases (significantly different by chi-squared, p-value= <0.005) were valid.



4.8 Year of Discharge from Hospital

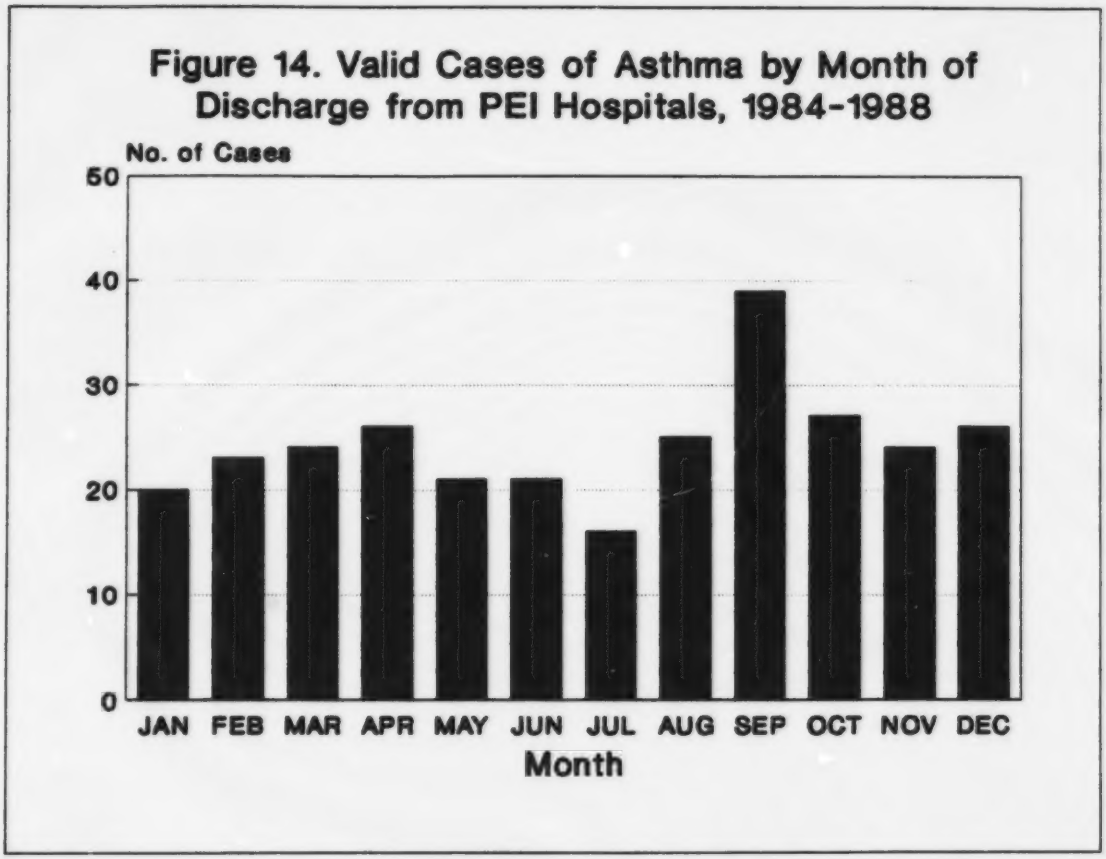
The annual number of valid cases of asthma discharged from PEI hospitals over the study period is shown in Table 3. Cases peaked in 1988 when there were 78. There was, however, a change in the reporting practice in one hospital during the study period whereby annual rates previously based on the calendar year were later calculated for the fiscal year. This change makes it impossible to assess accurately any trends in annual discharge rates over the study period.

Table 3. Annual Rates of Valid Asthma Cases Discharged from PEI Hospitals, 1984-1988

YEAR	CASES	RATE/100,000
1984	43	34.0
1985	53	41.8
1986	62	49.0
1987	56	44.2
1988	78	61.6

4.9 Month of Discharge from Hospital

Figure 14 shows the number of valid asthma cases by month of discharge from hospital over the study period. Two peaks were noted: a low peak in April and a higher peak in September. However, the change in the reporting procedure in one hospital described above may have resulted in an elevation in the number of discharges in January, February and March.



4.10 Duration of Hospitalization

The range of duration of hospitalization among valid cases was one to 46 days with a mean of 5.35 days and a standard deviation of 4.90 days.

4.11 Laboratory Investigations

The records reflected that nine (3.1%) of the valid cases had pulmonary function tests carried out and 18 (6.2%) had blood gases done while in hospital.

4.12 Triggering Factors

Factors suspected of triggering the asthmatic attack for which the patient was hospitalized were documented in 40% of cases. Table 4 shows an upper respiratory infection which was reported for 87 (29.8%) of valid cases reviewed. No other single triggering factor was identified by any more than three of the remaining 30 (11.0%) patients.

Table 4. Triggering Factor for Valid Asthma Cases, PEI, 1984-1988

TRIGGERING FACTOR	NO. OF CASES (%)
None identified	175(59.2)
Upper Respiratory Tract Infection	87(29.8)
Other Factor Identified*	30(11.0)

* All other factors identified three times or fewer

4.13 Allergies

Table 5 shows that at least one allergy was recorded on the charts of 125 (42.8%) of the valid cases. Penicillin was the commonest allergy which was noted for 36 (12.3%) of the patients.

Table 5. Commonest Allergies Reported in the Charts of Valid Asthma Cases, PEI, 1984-1988

	NO. (%)*
Reported an allergy	125 (42.8)
Penicillin	36 (12.3)
Dust	34 (11.6)
Feathers	20 (6.9)
Acetylsalicylic acid	14 (4.8)
Sulfa drugs	13 (4.5)
Cats	11 (3.8)
Pollens	10 (3.4)

* Includes multiple responses for some patients

4.14 Home Therapy

Table 6 shows the frequency of valid cases for whom specific antiasthmatic medications were prescribed for administration at home (documentation of anti-asthmatic medication available on 234 of 292 (80%) of charts). A total of 183 (62.7%) were prescribed a bronchodilator, 168 (57.5%) a xanthine compound, 55 (18.8%) a steroid (including betamethasone) and 24 (8.2%) sodium cromoglycolate.

Table 6. Home Medication Prescribed for Valid Asthma Cases, PEI, 1984-1988

MEDICATION	NO. PRESCRIBED MEDICATION(%)
BETA STIMULATOR	183(62.7)
XANTHINE	168(57.5)
STEROID	55(18.8)
SODIUM CROMOGLYCOLATE	24(8.2)

It was not possible to accurately determine the compliance rate for these medications because a significant number of the charts did not record such information.

4.15 Hospital Therapy

Table 7 shows the distribution of specific antiasthmatic medications administered to the asthma cases during the hospitalization. Treatment included a xanthine compound for 248 (84.9%) of cases, a bronchodilator by nebulizer for 247 (84.6%), steroids (including betamethasone) for 169 (57.9%) and epinephrine for 6 (2.1%).

Table 7. Medications Administered in Hospital to Valid Asthma Cases, PEI, 1984-1988

MEDICATION	NO. RECEIVING MEDICATION(%)
XANTHINE	248(84.9)
BRONCHO-DILATOR	247(84.6)
STEROID	169(57.9)
EPINEPHRINE	6(2.1)

5. DISCUSSION

In this study the diagnosis of asthma was valid in close to 88% of cases among those 10 to 39 years of age, with lower validity rates among those in the younger and older age ranges. These results would suggest that studies, based upon asthma data which have not been validated, may be more accurate among those aged 10 to 39 years old.

The major reason for cases being declared as invalid in this study was the absence of a documented history of asthma. Very few patients were assessed by the methacholine test in 1984-1988. This test could help in the validation of possible asthma among cases over five years of age.

The lower rate of hospitalization for asthma among rural residents of PEI as compared with urban dwellers is interesting in view of concerns in PEI related to the possible effect of agricultural chemicals on the rates of asthma in the Province.

It was noted that the percentage of valid asthma cases was significantly higher in those hospitals which used the HMRI system of reporting the discharge diagnosis. In this system, medical records staff select the "Primary Discharge Diagnosis" from a list of diagnoses provided by the physician, regardless of their order on the chart. In addition, staff review the hospital record and can change the discharge diagnosis to that illness which, in their opinion, is responsible for the greatest proportion of the patient's stay in hospital. Our findings suggest that studies of asthma hospitalization rates may be more valid when based on data from hospitals using the HMRI system and that efforts should be made to expand the use of this system to hospitals which are presently not using it.

With regard to the month of discharge from hospital, there was a low peak in the number of cases discharged in April and a high peak in September. This pattern is very similar to that reported from Ontario where peaks in asthma morbidity were noted in the spring and in the fall.[20]

The results of this study reveal a validity rate of 69% among patients discharged from PEI hospitals with a diagnosis of asthma between 1984 and 1988. The asthma morbidity rate for PEI calculated from discharge/separation data compiled by Statistics Canada for the period 1984 to 1987 was approximately three times the rate for all of Canada. If the rate is recalculated to reflect the validity level observed in this study, the rate would be close to double the national rate. However, since asthma hospitalization rates for the other provinces have not been validated, it is impossible to meaningfully compare validated results from this study with national data.

The findings of this study should be interpreted with an awareness of several possible biases:

1) This study involved only the review of charts of patients in PEI who had been discharged from hospital with a diagnosis of asthma. No attempt was made to identify those valid asthma cases who missed detection because they were discharged from hospital with a diagnosis other than asthma (i.e. the "false negatives").

2) Case definitions for asthma and rates of detection may not be consistent among all physicians.

3) The extent to which valid asthma cases are diagnosed and identified as the discharge diagnosis by physicians may vary.

4) Coding may not always accurately reflect the true discharge diagnosis.

5) The availability of beds in various hospitals may differ.

6) The admitting practices of physicians may vary.

It is important to distinguish hospitalizations from total morbidity because admission to hospital for asthma may depend upon many factors other than the number of asthmatics in a region.

A standardized community asthma prevalence study in a number of provinces would be an advisable means of comparing provincial asthma rates and provide an opportunity of better understanding the epidemiology of this disease across Canada.

SECTION 3

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Form 6 PROVINCE OF PRINCE EDWARD ISLAND (Canada)

DEPARTMENT OF HEALTH AND SOCIAL SERVICES

Division of Vital Statistics

REGISTRATION OF DEATH

Registration No. *(Department use only)*

THIS IS A PERMANENT RECORD
Type or Write Plainly in unfading Ink, and Complete All Items

NAME OF DECEASED

1. Surname of deceased *(print or type)* — All given names
2. SEX
Social Insurance Number

PLACE OF DEATH

3. Name of hospital or institution *(otherwise exact location where death occurred)* City, town, village or other place *(by name)* County Postal code

USUAL RESIDENCE

4. Complete street address. If rural give exact location *(not PO or RR address)* City, town, village or other place *(by name)* County Province *(or country)* Postal code

MARITAL STATUS

5. Single, married, widowed, or divorced *(specify)*

6. If married, widowed, or divorced, give full name of husband or full maiden name of wife

OCCUPATION

7. Kind of work done during most of working life

8. Kind of business or industry in which worked

BIRTHDATE

9. Month *(by name)*, day, year of birth

AGE

10. Age *(years)* | If under 1 year *(Months)* | *(Days)* | If under 1 day *(Hours)* | *(Minutes)*

BIRTHPLACE

11. City or place, province *(or country)* of birth

FATHER

12. Surname and given names of father *(print or type)*

13. BIRTHPLACE – City or place, province *(or country)*

MOTHER

14. Maiden surname and given names of mother *(print or type)*

15. BIRTHPLACE – City or place, province *(or country)*

SIGNATURE OF INFORMANT

16. Signature of informant
X

17. Address of informant

18. Relationship to deceased | 19. Date signed: *(month, day, year)*

MEDICAL CERTIFICATE OF DEATH

24. DATE OF DEATH: Month *(by name)*, day, year

Approx. interval between onset & death

25. CAUSE OF DEATH

Part I
Immediate cause of death (a) I
due to, or as a consequence of

Antecedent causes, if any, giving rise to the immediate cause (a) above, stating the underlying cause last
(b) .....
due to, or as a consequence of
(c) .....

Part II
Other significant conditions contributing to death but not causally related to the immediate cause (a) above II

26. Autopsy? Yes ☐ No ☐

27. Does the cause of death stated above take account of autopsy findings? Yes ☐ No ☐

28. May further information relating to the cause of death be available later? Yes ☐ No ☐

29. If accident, suicide, homicide or undetermined *(specify)*

30. Place of injury *(e.g. home, farm, highway, etc.)*

31. Date of injury?

32. How did injury occur? *(describe circumstances)*

33. I certify that the above named person died on the date and from the causes stated herein:
Signature *(attending physician, coroner, etc.)*
X

34. Designation: Attending physician ☐ Coroner ☐ Other ☐
Date certified: Month *(by name)*, day, year

35. Name of physician or coroner *(print or type)* Address:

DISPOSITION

Items 20 - 23 to be completed by the funeral director

20. Burial, cremation or other disposition *(specify)*

21. Date of burial or disposition. Month *(by name)*, day, year

22. Name and address of cemetery, crematorium or place of disposition

FUNERAL DIRECTOR

23. Name and address of funeral director *(or person in charge of remains)*

Notations:

I certify this return was accepted by me on this date at – P.E.I.

Record No. Date: Month *(by name)*, day, year Signature of District Registrar

8–2370–30.1: 10-9-86

See reverse side for instructions

53

APPENDIX 1

ICD CODE - ASTHMA

493 **Asthma**

493.0 *Extrinsic asthma*

Asthma:

- atopic
- allergic, stated cause
- childhood
- hay
- platinum

Hayfever with asthma

Excluded: asthma:

- allergic NOS (493.9)
- detergent (507.8)
- miners (500)
- wood (495.8)

493.1 *Intrinsic asthma*

Asthma due to internal immunological process
Late-onset asthma

493.9 *Asthma unspecified*

Asthma (bronchial)(allergic NOS) Status asthmaticus

Bronchitis:

- allergic
- asthmatic

APPENDIX 3

MORTALITY QUESTIONNAIRE

I DEMOGRAPHIC

1. Name_____Age_____

2. Date of Birth ___ _____ ____
day month year

3. Sex M/F

4. Street Address_____

City/Town_____

Prince County ___ Queen's County ____ King's County ____

Postal Code_____

5. Distribution: Rural ___ Urban ___ How long? ___Years

6. Occupation_____

II MEDICAL HISTORY

1. **Chart Number** _____ Hospital_____

2. **Onset age**_____ **Breast Fed?** Y/N

3. **Primary provider:** FP PAED INT RESP ALLERG

   How long?_____ Other providers?_____

4. **Most Recent Admission:**

   Admitted: ____ _____ _____
   Day Month Year

   Date Released: ____ ____ _____
   Day Month Year

   Triggering Factors_____

Clinical Measurement Done:

FEV _____

Bl. Gases _____

Others _____

Treatment: Theo Neb. bronchodilator steroids epinep O_2

Others_____

5. **Current home therapy:**

	inhaled	oral	nebulize	S/E
Dose/Freq.:				
B_2				
Theo.				
Ster.				
So. Cr.				
Others				

Compliance: Unknown Poor Average Good Excellent

6. **Allergies: (self)**

Pollen___ Dust/mite___ Food ___ ASA___Animal___Vegetation_____

Others_____

7. **Allergies: (Family)**

Pollen_____ Dust/mite_____ Food_____ ASA_____

Animal Vegetation_____ Others_____

8. **Family History of Asthma?** _____

9. **Number of Admissions last year** _____

10. **Number of office visits** _____ OPD visits_____

11. **Known Triggering factor:** Smoke pollens dustmite food Exercise Cold Air ASA animal vegetation infections others_____

12. **Other related medical conditions** _____

_____

13. **Place of Death** _____

14. **Circumstances** _____

15. **Autopsy:** Y/N

Gross_____

Micro_____

III LIFESTYLE

1. **Smoke (self):** Never Ex Yes/Unk # <10 10-20 20-40 >40
   Cig/Day

   Length of Time: Never Ex Yes/Unk # <10 10-20 20-40 >40

   Smoke (family):
   Cig/Day

Father		Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Mother		Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Sibling	1	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
	2	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
	3	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Other	1	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
	2	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
	3	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40

2. **Alcohol** Never Ex Yes/Unk # <2 2-5 5-10 >10
   per day

3. **Exercise/wk** Never Yes/Unk. times <2 2-5 >5

IV OCCUPATION

Presence of: Agric (eg hay)_____ 'tight' office _____

chemical (fume)_____ chemical (dust)_____ animals_____

others_____

V TIME TREND

Time of year _____
day month year

Time of day _____**Time of death**_____

Duration of attack_____

VI ACCESS TO HEALTH CARE

Distance to FP (km)	<2	2-5	5-15	15-30	>30
Distance to clinic (km)	<2	2-5	5-15	15-30	>30
Distance to hospital (km)	<2	2-5	5-15	15-30	>30

APPENDIX 4

ASTHMA HOSPITALIZATION QUESTIONNAIRE

1. **History of Asthma:**

   Asthma diagnosed previously
   Hospitalized previously with symptoms of asthma
   Documentation of clinical airflow obstruction
   Documentation of bronchial hyperresponsiveness

2. **Presence of symptoms on admission:**

   Shortness of breath
   Wheezing
   Cough with characteristic onset

3. **During hospitalization:**

   Documentation of clinical airflow obstruction
   Improved after specific antiasthmatic treatment

I **DEMOGRAPHIC**

1. **Name**_____**Age**_____

2. **Date of Birth** ___ _____ ____
   day month year

3. **Sex** M/F

4. **Street Address**_____

   City/Town_____

   Prince Co___ Queen's Co___ King's Co.___ Postal Code_____

5. **Distribution:** Rural____ Urban____ How long? _____Years____

6. **Occupation**_____

II MEDICAL HISTORY

1. Chart Number _____ Hospital_____

2. Onset age_____ Breast Fed? Y/N

3. Primary provider: FP PAED INT RESP ALLERG

How long?_____Other providers?_____

4. Current Admission:

Admitted: ____ _____ _____ Date Released: ____ _____ _____
Day Month Year Day Month Year

Triggering Factors_____

Clinical Measurement Done: FEV _____

Bl. Gases _____

Others _____

Treatment: Theo Neb. bronchodilator steroids epinep O_2

Others_____

5. Current home therapy:

	inhaled	oral	nebulize	S/E	Dose/Freq.
B_2					
Theo.					
Ster.					
So. Cr.					
Others					

Compliance: Unknown Poor Average Good Excellent

6. **Allergies: (self)**

Pollen___ Dust/mite___ Food ___ ASA___Animal___ Vegetation_____

Others_____

7. **Allergies: (Family)**

Pollen___ Dust/mite___ Food___ ASA___ Animal Vegetation_____

Others_____

8. **Family History of Asthma?** _____

9. **Number of Admissions last year**_____

10. **Number of office visits**_____ OPD visits_____

11. **Known Triggering factor:** Smoke pollens dust mite food exercise cold air ASA animal vegetation infections others_____

12. **Other related medical conditions**_____

_____

III LIFESTYLE

1. Smoke (self): Cig/Day	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Length of Time:	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Smoke (family): Cig/Day							
Father	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Mother	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Sibling 1	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
2	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
3	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
Other 1	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
2	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
3	Never	Ex	Yes/Unk #	<10	10-20	20-40	>40
2. Alcohol per day	Never	Ex	Yes/Unk #	<2	2-5	5-10	>10
3. Exercise/wk	Never		Yes/Unk. times		<2	2-5	>5

IV OCCUPATION

Presence of: Agric (eg hay)_____ 'tight' office _____

chemical (fume)_____ chemical (dust)_____

animals_____ others_____

V TIME TREND

Time of year _____
day month year

Time of day _____ **Time of death**_____

Duration of attack_____

VI ACCESS TO HEALTH CARE

Distance to FP (km)	<2	2-5	5-15	15-30	>30
Distance to clinic (km)	<2	2-5	5-15	15-30	>30
Distance to hospital (km)	<2	2-5	5-15	15-30	>30